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               REAL-TIME LABORATORY NETWORK DEVELOPMENT AND MAINTENANCE.(U)
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FINAL REPORT
(Contents Unclassified)
CONTRACT #N00014-80-C-0032

OFFICE OF NAVAL RESEARCH

Peal-Time Laboratory Network
Development and Maintenance

Submitted by:

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Automation Counselors, Incorporated

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CONTRACT ACCOMPLISHMENTS
Real-Time Laboratory Network Development and Maintenance

Contract #N00014-80-C-0032

Automation Counselors, Inc.(ACI), working at the Naval Medical
Research Institute's Hyperbaric Medicine Program Center was
directed to address five functional areas of network develop-
ment and maintenance. These five areas were:

- Continued design and development of an NMRI
  laboratory network.

- Performance of highly specialized network system
  maintenance.

- Integration of laboratory instrumentation and
  general purpose systems into the evolving network.

- Monitoring and enhancing the effectiveness of
  the network.

- Documenting modified system services and training
  new users.

The accomplishments by Automation Counselors, Inc., in
each of these areas are discussed in the paragraphs below.

DESIGN OF LABORATORY NETWORK

The laboratory network grew with the addition of several
new PDP-11/34 computers. This brings the total number of 11/34
laboratory machines in the network to four. The operating
systems for the new machines were generated (including DECNET)
and they were integrated into the network. These additional
satellite computers were necessary because the resources of
the existing machines were being strained to their maximum.

The VT-11 graphics hardware was removed from the 11/40
and installed in a PDP-11/04. This resulted in a portable
graphics display terminal known as a GT-40. It now became
possible to connect this graphics terminal to any of the net-
work machines via an RS-232 interface giving greatly increased
flexibility. The software supporting this terminal was installed
on all machines.

Finally, the ACI staff participated in making decisions
concerning new hardware and software purchases by NMRI, assuring
compatible laboratory equipment and network capabilities.

NETWORK SYSTEM MAINTENANCE

Early in the contract, RSX-11M Version 3.2 was installed on all systems. In the last year of the contract, RSX-11M PLUS was installed in the PDP-11/70 in such a manner that it was unnoticed by the users. The installations of DEC released patches and ACI alterations were constant assignments.

Under circumstances of heavy load the RSX-11M executive will slow down and stop. This is because the executive has a limited amount of dynamic pool space which it may use. This is more than a minor problem because the users get no warning of an impending lockup. ACI programmer re-wrote a program from DECUS (Digital Equipment Corporation Users Society) which helps to prevent this problem by checking the remaining pool space at regular intervals. If this program detects an impending lockup it sends a message warning all logged in users of the problem. Under extreme circumstances this program can actually take over control from the executive and allow an operator to abort tasks from the console until the problem is cleared up.

The DEC supplied driver for the clock in the LPA-11K laboratory subsystem offers no protection against changes in the clock rate by another user. For this reason a control task was written which arbitrates between multiple users on the CPU.

The new ANSII standard FORTRAN-77 compiler was installed on all systems in the network. Because of added features of FORTRAN-77 such as structured constructs and character variables the programming staff were able to increase their productivity.

A resident common area for FORTRAN 4 PLUS was installed on the PDP-11/34 lab machines. This allows common OTS code to be shared between tasks, allowing more efficient use of both disk and memory.

Early in the contract ACI personnel helped make some important recommendations regarding increasing the performance of the PDP-11/70. Because of increasing user demand for time on the main machine, the system as it stood was overloaded. These recommendations encompassed both hardware and software upgrades including bulk core for faster swapping, dual ports and a second controller for the RP-06 disk drives to increase I/O speed, and an operating system change to RSX-11M PLUS. Near the conclusion of the contract RSX-11M PLUS was installed in such a manner that the change-over was virtually unnoticed by the users.

INTEGRATION OF NEW SYSTEM COMPONENTS

During the course of the contract it became necessary on several occasions to interface new equipment with the network laboratory machines. This equipment includes HP-9825's, Nicolet oscilloscopes, and a Beckman process controller. Communication with a CPU is achieved through digital, analog, RS-232, and IEEE interfaces.

As supplied by DEC the driver for the IEEE interface was not functioning properly. The problem was analyzed by ACI personnel and some corrections were made to the driver code. This resulted in improved performance of the IEEE buss.

A program was written to allow a general purpose transfer of data from a Nicolet oscilloscope to a disk data file by way of the IEEE interface.

New digitizers were installed on all the machines in the network. The programs that worked with the old digitizer were easily upgraded by changing only subroutines that communicate with the digitizer.

System programming was done to allow the transfer of data from the HP-9825 to a PDP-11 file using the IEEE buss to the 11/34A. Some communications problems arose and were solved. A second investigator requested transfer of his data to the 11/34B from the HP-9825. Both transfer tasks were completed on time.

The Canbera multichannel analyser (MCA) interface was tested and a program written according to the experimental protocol. The MCA system can count the radioactivity of various energy sources (different isotopes) coming from different physical sites.

MONITOR NETWORK EFFECTIVENESS

Several contract assignments under this area have been mentioned, including the timing analysis on the PDP 11/34B to allow it to be used for real-time work; the installation of DECNET to improve communications; and the fine-tuning of the several CPU's through sysgens of the operating system.

In addition, a user log utility was installed to place all user activity on a disk file for accounting and network use analysis. Plotter and graphics usage was upgraded several ways, as discussed above. The operating system was upgraded both with DEC releases and ACI written modifications.

General assignments carried out during the contract period included monitoring data transfer rates between host and satellite systems; monitoring peripheral resource sharing; and evaluating upgraded operating system and general utility software to determine the expanded network capabilities.

DOCUMENTATION AND TRAINING

The ACI staff held both formal and informal training sessions with appropriate user personnel. This occurred to acquaint the users with new software such as graphics or operating system changes, and with new equipment.

Datatrieve Database training was given to users of this DEC software package.